

Pathology Pathways

An Atlas & Self-Assessment



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AN ATLAS AND SELF ASSESSMENT

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AN ATLAS AND SELF ASSESSMENT

Zainal Abidin Ibrahim
Mohd Zulkarnaen A Narihan
Dayangku Norlida A Ojep



Universiti Malaysia Sarawak,
2012

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PATHOLOGY PATHWAYS: AN ATLAS AND SELF ASSESSMENT

FOREWORD

This book illustrates the macroscopic features of diseased organ according to the respective human body systems. The aim of this book is to supplement the function of UNIMAS pathology museum in enhancing the process of teaching and learning. We are hopeful that the subject of Pathology will become more interesting and fascinating to medical students. Each case in this book is equipped with UNIMAS Pathology Resource Facility serial number for easy reference.

In this book, the clinical presentation of the cases and the important pathological features of the disease organ are highlighted. The pathological features are further accompanied with explanation with regards to the pathogenesis.

Each case is also supplemented with the macroscopic description of the disease and also multiple choice questions (MCQ) with answers. The purpose of the MCQ is to reinforce the knowledge associated with the lesion. Students are encouraged to visit the UNIMAS Pathology Resource Facility to compare the pictures in this book with the actual specimens which are made available for them.

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7 December 2011

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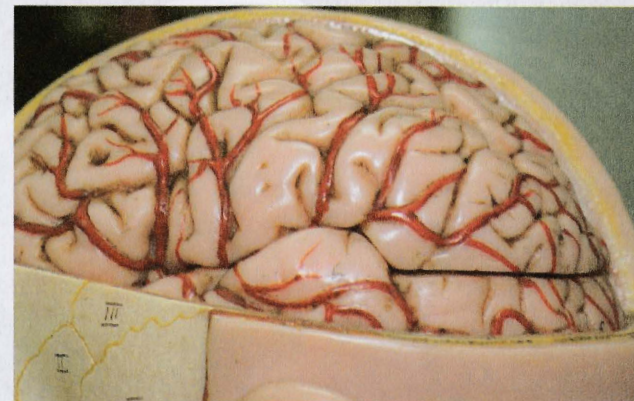
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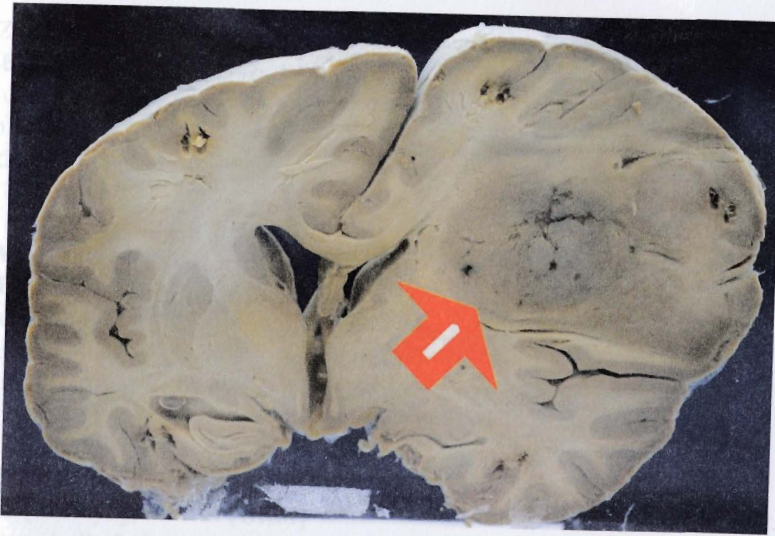
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CHAPTER 1: CENTRAL NERVOUS SYSTEM



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CNS CASE 1



DIFFUSE ASTROCYTOMA (WHO GRADE II)

CLINICAL HISTORY

A 36-year-old man presented with recurrent temporal headache for the past six months. Recently, the patient experienced an episode of seizure. CT scan showed a non-contrast enhancing brain mass.

MACROSCOPIC DESCRIPTION

The red arrow points to the neoplastic mass which is located at the left temporal lobe of the brain. The tumour displays diffuse grayish rounded mass with ill-defined infiltrative outer margin. The mass expands and invades the surrounding brain tissue (enlargement and distortion). The mass is firm in consistency. No obvious area of necrosis or haemorrhage seen in this specimen. This tumour is a low-grade infiltrative neoplasm.

MULTIPLE CHOICE QUESTIONS

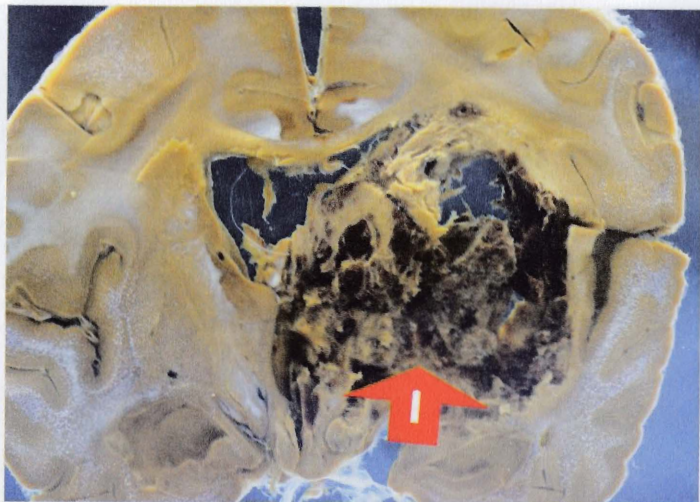
Regarding primary brain tumour:

1. High-grade glioma exhibits early metastasis outside the central nervous system.
2. Glioma originates from oligodendrocyte.
3. Ependymoma presents with hydrocephalus in childhood.
4. Medulloblastoma arises at the temporal lobe of the cerebrum.
5. It is associated with tentorial herniation.

ANSWERS

1. **False.** Primary brain tumour rarely metastasizes outside the central nervous system.
2. **True.** Glioma is a tumour derived from glial cells including astrocytes, oligodendrocytes and ependymal cells.
3. **True.** Ependymoma often arises from ependyma-lined ventricular system. Occlusion of the fourth ventricle at this age is associated with hydrocephalus.
4. **False.** Medulloblastoma is a childhood tumour which exclusively occurs at the cerebellum.
5. **True.** Any enlarging tumour at the supratentorial compartment can produce increase in intracranial pressure and cause brain herniation through the tentorial notch.

CNS CASE 2



GLIOBLASTOMA MULTIFORME (WHO GRADE IV)

CLINICAL HISTORY

A 40-year-old man presented with progressive headache associated with personality change for the past one month. CT scan showed a non-contrast enhancing brain mass.

MACROSCOPIC DESCRIPTION

The red arrow points to the tumour mass which is located at the left temporal lobe of the brain. The tumour mass invades the left basal ganglia area and extends to the right cerebral hemisphere. The mass distorts the left lateral ventricle. It forms extensive areas of necrosis with cystic appearance. This indicates that it is a high-grade malignancy. The tumour is irregularly-shaped and poorly delineated. The remaining mass is generally grayish in colour.

MULTIPLE CHOICE QUESTIONS

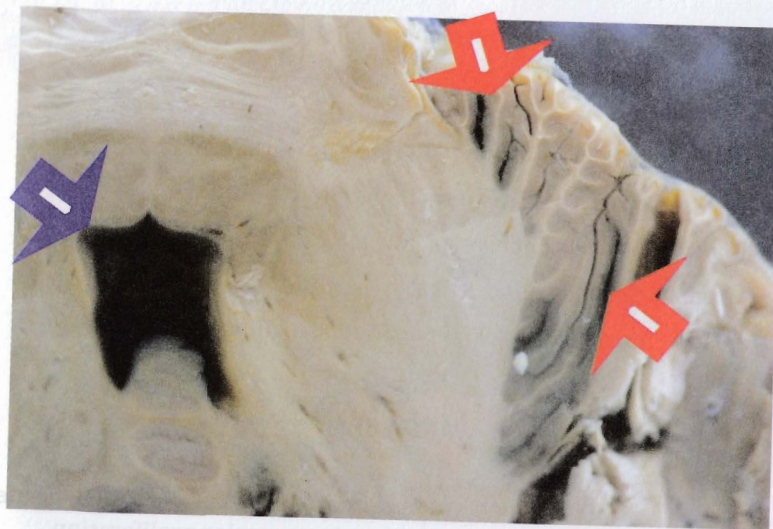
Regarding glioma:

1. Glioblastoma multiforme (GBM) is a low-grade glioma.
2. Diffuse astrocytoma displays high mitotic activity.
3. Pilocytic astrocytoma is typically located at the posterior fossa.
4. Vascular proliferation is a feature of GBM.
5. Rosette formation is seen in oligodendroglioma.

ANSWERS

1. **False.** GBM is a high-grade primary brain tumour (WHO grade IV: neoplasm involving microvascular proliferation and necrosis).
2. **False.** Astrocytoma with high mitotic activity includes anaplastic astrocytoma and GBM.
3. **True.** This tumour typically occurs in children and young adults.
4. **True.** This feature is seen in high-grade glioma (both anaplastic and GBM) and not seen in low-grade glioma.
5. **False.** It is seen in ependymoma and not in oligodendroglioma.

CNS CASE 3



CEREBELLAR HAEMORRHAGE

CLINICAL HISTORY

A 30-year-old man suffered a blunt trauma to the back of the head after he was hit with a baseball-bat during a gang-fight. The man passed away at the scene of crime.

MACROSCOPIC DESCRIPTION

The red arrows point to the areas of haemorrhage. The blue arrow points to the aqueduct. There are areas of haemorrhage at the cerebellar parenchyma and also within the ventricular system (intracerebellar and intraventricular haemorrhage)

MULTIPLE CHOICE QUESTIONS

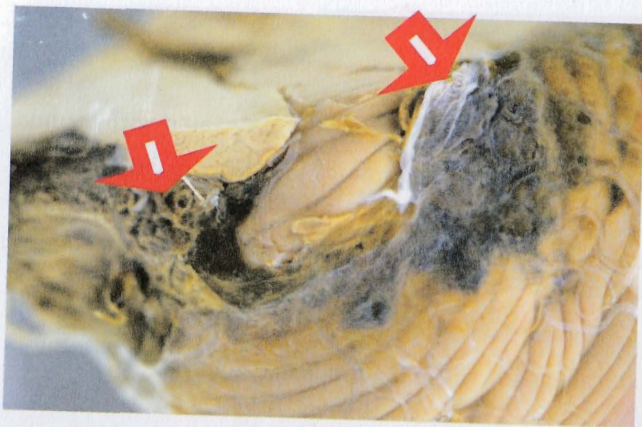
Regarding glioma:

1. Subdural haemorrhage is typically associated with trauma.
2. Epidural haemorrhage is associated with uncontrolled hypertension.
3. Subarachnoid haemorrhage is caused by ruptured Charcot Bouchard microaneurysm.
4. It is associated with polycystic kidney disease.
5. Epidural haemorrhage is venous in origin.

ANSWERS

1. **True.** It is commonly associated with elderly and children.
2. **False.** Epidural haemorrhage is commonly caused by fracture-related rupture of the middle meningeal artery.
3. **False.** Charcot Bouchard aneurysm is seen in hypertension and causes intracerebral haemorrhage.
4. **True.** Polycystic kidney is associated with other lesions including cerebral berry aneurysm and liver cysts.
5. **False.** It is arterial in origin (middle meningeal artery).

CNS CASE 4



SUBARACHNOID HAEMORRHAGE

CLINICAL HISTORY

A 56-year-old man suffered a fatal head injury after a motor-vehicle accident. The man was the front passenger of a car which collided head-on against a tree.

MACROSCOPIC DESCRIPTION

The red arrows point to the haemorrhagic areas located underneath the arachnoid layer of the cerebellum.

MULTIPLE CHOICE QUESTIONS

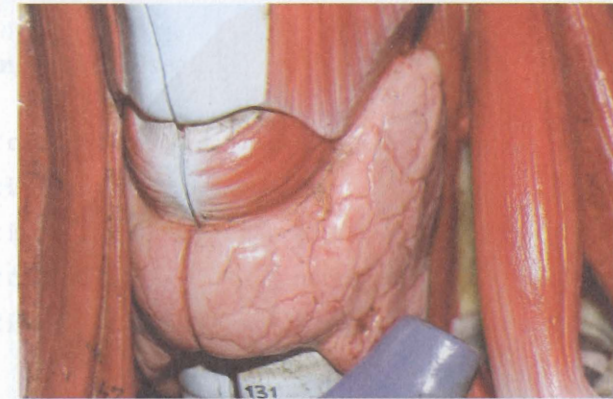
Causes of subarachnoid haemorrhage include

1. rupture of berry aneurysm.
2. trauma.
3. hypertensive brain haemorrhage.
4. vascular malformation.
5. rupture of middle meningeal artery.

ANSWERS

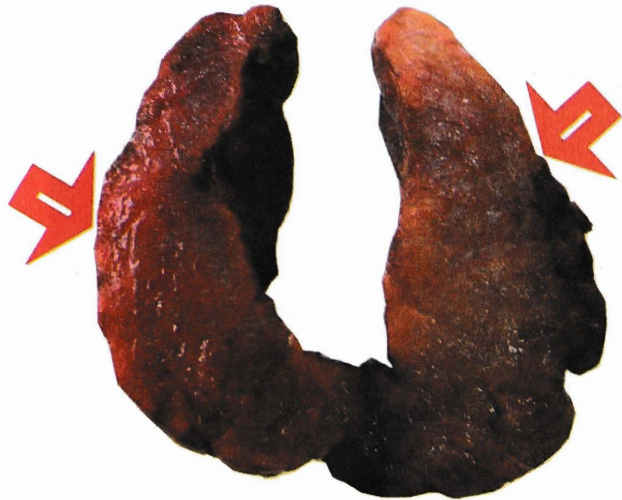
1. **True.** It is a common non-traumatic cause of subarachnoid haemorrhage.
2. **True.** As exemplified in this case.
3. **True.** It is associated with extension of an intraparenchymal haemorrhage seen in hypertension.
4. **True.** Especially if the lesion is located at the subarachnoid space.
5. **False.** This is associated with extradural haematoma

CHAPTER 2: ENDOCRINE SYSTEM



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ENDOCRINE CASE 1



GRAVES DISEASE OF THYROID

CLINICAL HISTORY

A 35-year-old woman presented with palpitation and anterior neck swelling of two weeks duration. On physical examination, there is an abnormal protrusion of the eyeballs (exophthalmos).

MACROSCOPIC DESCRIPTION

The red arrows point to a symmetrical enlargement of the thyroid gland in Graves disease due to diffuse hypertrophy and hyperplasia of the gland. It has a homogeneous meaty cut surface resembling normal skeletal muscle. There are no nodules seen in this specimen.

MULTIPLE CHOICE QUESTIONS

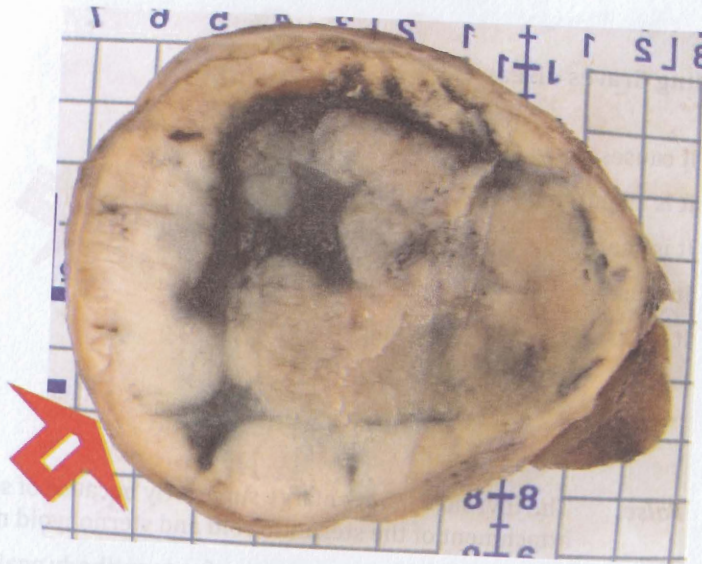
Regarding Graves disease:

1. It causes the gland to enlarge superiorly.
2. It is an autoimmune disorder.
3. It is characterised by infiltrative ophthalmopathy.
4. It causes increase in β -adrenergic tone.
5. It is associated with pretibial myxoedema.

ANSWERS

1. **False.** The thyroid cannot enlarge superiorly because of superior attachment of the sternothyroid and sternohyoid muscle.
2. **True.** It is associated with presence of autoantibody against the TSH receptor.
3. **True.** These changes are only seen in Graves disease.
4. **True.** It induces tachycardia, palpitation, tremulousness and anxiety.
5. **True.** Myxoedema generally refers to hypothyroidism. However, in Graves disease, apart from ophthalmopathy, this skin lesion is also a feature.

ENDOCRINE CASE 2



MEDULLARY CARCINOMA OF THE THYROID

CLINICAL HISTORY

A 56-year-old woman presented with an anterior neck swelling associated with weight loss and poor appetite. She had a history of pheochromocytoma which was surgically removed five years ago.

MACROSCOPIC DESCRIPTION

The red arrow points to the thyroid gland mass enlargement with total effacement of the remaining thyroid tissue. This is a solitary grayish to tan coloured tumour with central area of necrosis and haemorrhage. The tumour is confined to the gland with no obvious gross involvement of the outer capsule.

MULTIPLE CHOICE QUESTIONS

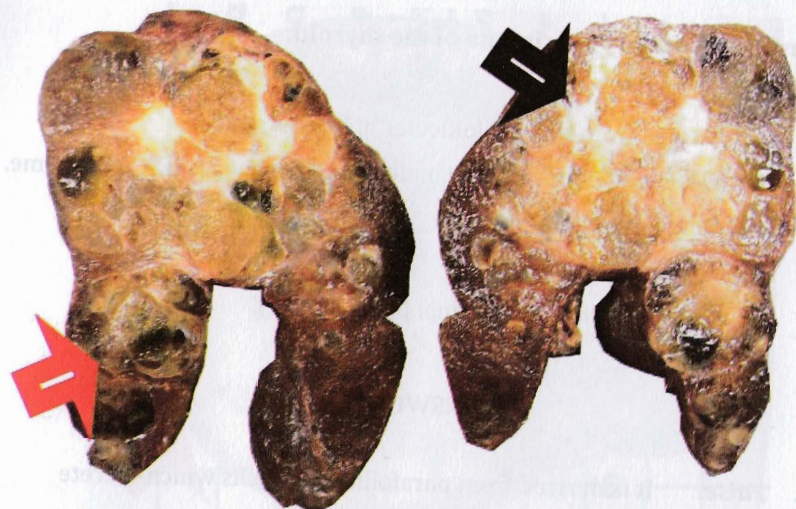
Regarding medullary carcinoma of the thyroid:

1. It is derived from thyroid follicular epithelial cells.
2. It is associated with multiple endocrine neoplasia (MEN) syndrome.
3. It secretes amyloid material.
4. It forms follicular pattern.
5. It secretes vasoactive intestinal peptide (VIP).

ANSWERS

1. **False.** It is derived from parafollicular C cells which secrete calcitonin.
2. **True.** The familial tumour occurs in multiple endocrine neoplasia (MEN 2).
3. **True.** The abnormal protein is derived from altered calcitonin molecule produced by the tumour cells.
4. **False.** This tumour does not form follicular formation such as seen in follicular carcinoma. It forms sheets pattern.
5. **True.** It is not just secreting calcitonin. It also elaborates somatostatin, serotonin and VIP.

ENDOCRINE CASE 3



MULTINODULAR GOITRE

CLINICAL HISTORY

A 60-year-old woman presented with a long standing anterior neck swelling for the past ten years. On physical examination, there was an asymmetrical nodular enlargement of the thyroid gland.

MACROSCOPIC DESCRIPTION

The red arrow points to the nodules of various sizes which are seen throughout the thyroid cut-surface. The nodules are mainly filled with colloid material. The black arrow points to the area of fibrosis in between the nodules. Fibrosis and haemorrhage are degenerative changes that are commonly seen in multinodular goitre.

MULTIPLE CHOICE QUESTIONS

Multinodular goitre

1. is caused by impaired thyroid hormone synthesis.
2. is endemic at mountainous area.
3. displays thyroid gland hyperplasia.
4. is associated with low level of TSH.
5. is associated with hyperthyroidism.

ANSWERS

1. **True.** Most often caused by iodine deficiency leading to compensatory rise in TSH stimulation.
2. **True.** Endemic goitre occurs in areas associated with low level of iodine in the food supply, water and soil.
3. **True.** Two phases occur in MNG including hyperplastic phase and colloid involution phase. Hyperplasia is required as part of compensatory mechanism in response to iodine deficiency.
4. **False.** TSH is usually elevated or at upper range of normal whilst the T3 and T4 are normal.
5. **True.** Substantial minority developed hyperfunctioning nodule resulting in toxic MNG.

ENDOCRINE CASE 4



PAPILLARY CARCINOMA OF THE THYROID

CLINICAL HISTORY

A 23-year-old woman presented with a solitary neck swelling of one month duration. Fine needle aspiration showed metastatic papillary carcinoma. A total thyroidectomy was performed.

MACROSCOPIC DESCRIPTION

The red arrow highlights the infiltrative tumour mass located near the outer surface of the thyroid lobe. This is a solitary tumour affecting the thyroid. The tumour mass exhibits whitish surface with ill-defined outer margin. This indicates infiltrative nature of the lesion. Patchy areas of calcification can be seen at the centre of the lesion.

MULTIPLE CHOICE QUESTIONS

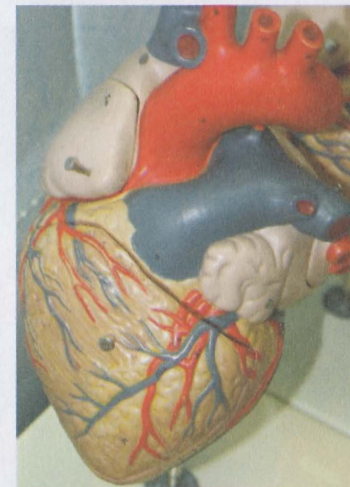
Regarding papillary carcinoma of the thyroid, it

1. has male predominance.
2. is associated with radiation exposure.
3. exhibits calcification.
4. has an excellent prognosis.
5. represents dedifferentiation of follicular carcinoma.

ANSWERS

1. **False.** It has female predominance particularly among early and young adults.
2. **True.** It is the commonest thyroid carcinoma variant associated with ionic radiation.
3. **True.** It is commonly presents with concentric calcified structure termed psammoma bodies within the core of the papillae.
4. **True.** It has ten year survival rate of 95%.
5. **False.** This is anaplastic carcinoma which is a highly aggressive and lethal variant of thyroid carcinoma.

CHAPTER 3: CARDIOVASCULAR PATHOLOGY



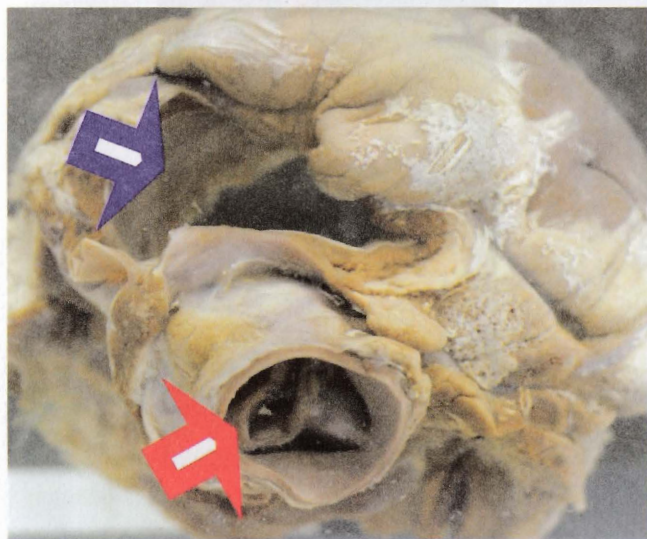
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CARDIOVASCULAR CASE 1



PICTURE 1

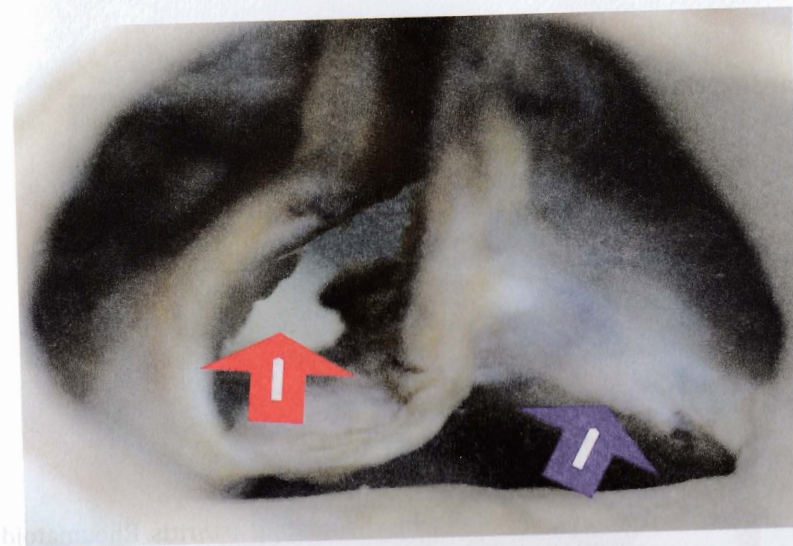
CHRONIC RHEUMATIC HEART DISEASE WITH AORTIC STENOSIS

CLINICAL HISTORY

A 40-year-old man presented with exercise induced syncope and dyspnoea. On physical examination, an ejection systolic murmur at aortic area was noted. Electrocardiogram showed left ventricular strain pattern. He had episodes of rheumatic fever during his childhood.

MACROSCOPIC DESCRIPTION

The blue arrow points to the left ventricular lumen while the red arrow points to the aortic valve. The aortic valve displays features of aortic stenosis (see picture 2).



PICTURE 2

AORTIC VALVE FUSION IN CHRONIC RHEUMATIC HEART DISEASE

MACROSCOPIC DESCRIPTION

The red arrow points to the narrowing caused by fusion of the aortic valve cusps (blue arrow). Therefore the patient presents with features of aortic stenosis. Distortion of the cusps and commissural fusion are features seen in rheumatic heart disease. Commissural fusion is not commonly seen in valvular degeneration caused by calcification.

MULTIPLE CHOICE QUESTIONS

Regarding chronic rheumatic heart disease:

1. It is associated with rheumatoid arthritis.
2. It presents with valvular commisural fusion.
3. It is a complication of acute rheumatic carditis.
4. It is due to hypersensitivity reaction.
5. Destructive valvular vegetation is a feature.

ANSWERS

1. **False.** It is not associated with rheumatoid arthritis. Rheumatoid arthritis is an autoimmune disease of the joints.
2. **True.** This is a characteristic of chronic rheumatic heart disease. Cusp fusion is not commonly seen in calcific degeneration. Thickening spares the cuspal free edges.
3. **True.** Acute rheumatic carditis occurs during active phase of rheumatic fever and may involve endocardium, myocardium and pericardium (pancarditis).
4. **True.** It is strongly associated with hypersensitivity reaction towards group A streptococci (usually pharyngitis).
5. **False.** This feature is commonly seen in infective endocarditis. However valvular defect caused by rheumatic fever is a predisposing factor for infective endocarditis.

MACROSCOPIC DESCRIPTION

The blue arrow points to the left ventricular lumen while the red arrow points to the aortic valve. The aortic valve displays features of aortic stenosis (see picture 2).

CARDIOVASCULAR CASE 2



LEFT VENTRICULAR HYPERTROPHY

CLINICAL HISTORY

A 67-year-old man presented with recurrent episodes of crushing central chest pain which was exacerbated by exercise. He suffered from hypertension for the past 15 years.

MACROSCOPIC DESCRIPTION

The red arrows point to the concentric thickening of left ventricular myocardium due to myocardial hypertrophy. The thickness of the left ventricular wall exceeds 2 cm and the heart weighs 750 grams. This is a cellular adaptation process in response to elevated systemic blood pressure. Myocardium is a permanent cell which incapable of dividing. Therefore hypertrophy occurs. There is reduction in the lumen size. The muscle hypertrophy imparts stiffness that impairs diastolic filling.

MULTIPLE CHOICE QUESTIONS

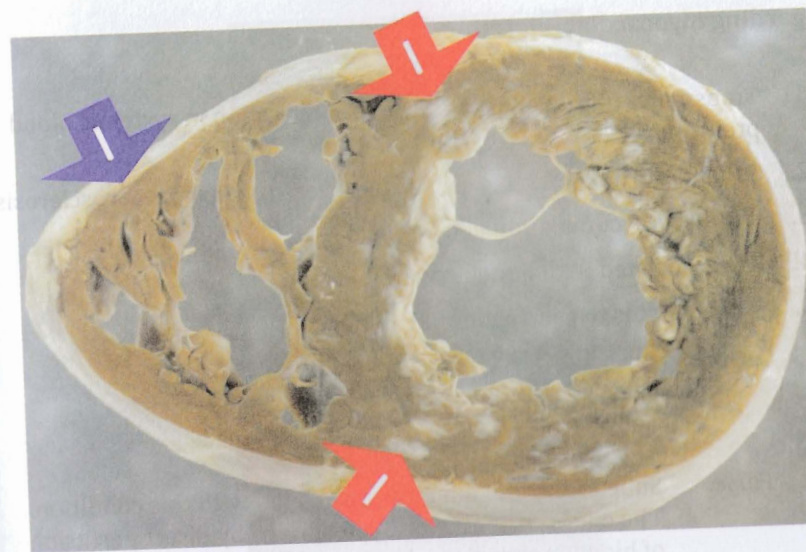
The following statements are true about hypertension.

1. Hyaline arteriolosclerosis is seen in the kidney.
2. Hyperplastic arteriolitis is seen in malignant hypertension.
3. Hypertension accelerates atherogenesis.
4. Microscopically the earliest change is interstitial fibrosis of the heart.
5. It causes an increase in heart weight disproportionate to its size.

ANSWERS

1. **True.** Hyaline arteriolosclerosis is seen in the arterioles whereas atherosclerotic changes are seen in the arteries of those with hypertension.
2. **True.** This refers to intimal thickening due to proliferation of elongated concentrically arranged smooth muscle cells of the renal interlobular arteries and arterioles. These changes are seen in renal failure in malignant hypertension.
3. **True.** Hypertension accelerates atherogenesis and causes structural changes that potentiate aortic dissection and cerebrovascular haemorrhage.
4. **False.** This change is seen at advanced stage of the disease.
5. **True.** Hypertension induced left ventricular hypertrophy due to pressure overload without causing luminal dilatation.

CARDIOVASCULAR CASE 3



MYOCARDIAL INFARCTION

CLINICAL HISTORY

A 76-year-old man presented with severe crushing central chest pain which was not relieved by rest or sublingual glyceryl trinitrate (GTN). He was previously treated for myocardial infarction with balloon angioplasty.

MACROSCOPIC DESCRIPTION

The red arrows point to the scarring seen at the left ventricular wall. The scar develops after the first episode of myocardial infarction. The blue arrow points to the right ventricle. Necrotic cardiac muscle elicits acute inflammation. Thereafter macrophage will remove the necrotic tissue and it will be replaced by granulation tissue and fibrosis.

MULTIPLE CHOICE QUESTIONS

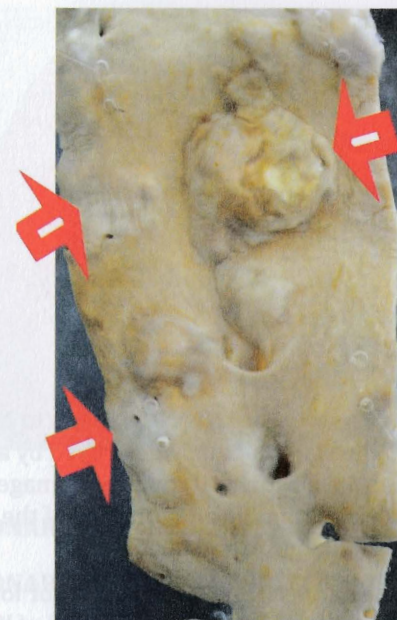
Regarding myocardial infarction:

1. Transmural infarction is due to severe reduction in systemic blood pressure.
2. Subendocardial infarct is caused by severe coronary atherosclerosis.
3. It induces accumulation of lactic acid.
4. It is associated with liquefactive necrosis.
5. It contributes to ventricular fibrillation.

ANSWERS

1. **False.** Subendocardial infarct is associated with this condition. The endocardium is mainly supplied by direct perfusion of blood in the ventricle.
2. **False.** Severe coronary atherosclerosis usually causes transmural infarct.
3. **True.** This is due to anaerobic glycolysis that occurs after coronary artery occlusion hence depriving of oxygen.
4. **False.** This is a solid organ hence produce coagulative necrosis pattern.
5. **True.** Myocardial infarction causes electrical instability (irritability) and may be the cause of death.

CARDIOVASCULAR CASE 4



COMPLICATED ATHEROSCLEROSIS AT ABDOMINAL AORTA

CLINICAL HISTORY

A 60-year-old man presented with acute abdominal pain. Physical examination showed a pulsating mass at the umbilical region. Abdominal aortic aneurysm was diagnosed. The man was a chronic smoker with a longstanding diabetes mellitus.

MACROSCOPIC DESCRIPTION

The red arrows highlight the atherosclerotic plaques which are seen at the luminal surface of the abdominal aorta. The plaques are composed of raised focal lesions with yellowish grumous core covered by firm whitish fibrous cap. The plaque at the upper side of the picture displays complicated lesion with surface defect, rupture and ulceration. This will initiate haematoma and thrombosis.

MULTIPLE CHOICE QUESTIONS

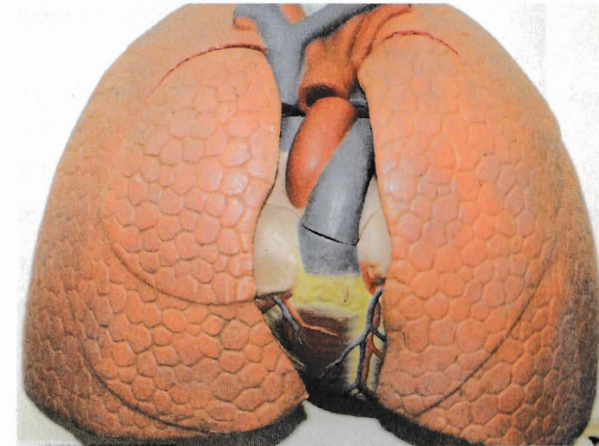
Regarding atherosclerosis:

1. It causes weakening of the blood vessel wall.
2. Fatty streak is an early lesion.
3. It is caused by chronic inflammation.
4. It involves tunica media thickening.
5. Hyperlipidaemia causes direct endothelial injury.

ANSWERS

1. **True.** Even though the word sclerosis refers to hardening of the vessels. The wall is actually destroyed by atherosclerosis and loses its elasticity. It involves damage to the internal, external elastic lamina and thinning of the tunica media. It may cause dilatation and aneurysm.
2. **True.** This is the earliest lesion and precursor for atherosclerotic plaque. It is composed of lipid-filled macrophages.
3. **True.** Pathogenesis of atherosclerosis is called response to injury hypothesis where it is considered to be a chronic inflammatory response of the arterial wall to some endothelial cell injuries.
4. **False.** Smooth muscle cells from tunica media migrate into the tunica intima where they proliferate and lay down extracellular matrix. This causes intimal thickening.
5. **True.** It directly impairs the endothelial cell function through increased production of oxygen radicals and deactivates nitric oxide. Nitric oxide functions as an endothelial relaxant.

CHAPTER 4: RESPIRATORY SYSTEM



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RESPIRATORY CASE 1



PULMONARY TUBERCULOSIS

CLINICAL HISTORY

A 65-year-old man presented with prolonged cough associated with productive yellowish sputum and low-grade fever for the past three months. He also experienced malaise, anorexia and night sweats. Chest radiograph showed lung abnormality.

MACROSCOPIC DESCRIPTION

There is a gray-whitish mass with cavitation and irregular outer margin. The cavitation is associated with caseation necrosis with peripheral fibrosis. The lesion is typically located at the apical region of the lung. Granuloma formation with caseation necrosis is the typical histological features for tuberculosis.

MULTIPLE CHOICE QUESTIONS

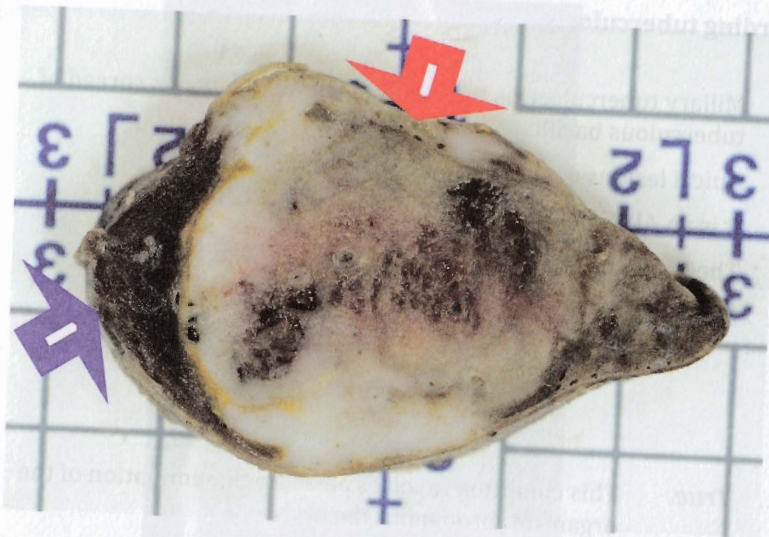
Regarding tuberculosis:

1. Miliary tuberculosis is the result of haematogeneous spread of tuberculous bacilli.
2. Apical lesions occur in secondary tuberculosis.
3. It is an AIDS-defining condition.
4. The bacilli proliferate within macrophage phagosome.
5. It elicits type III hypersensitivity reaction.

ANSWERS

1. **True.** This condition involves an acute dissemination of the organism throughout the body.
2. **True.** High oxygen tension at the apices promotes the growth of these aerobic bacilli.
3. **True.** It is also associated with any immunocompromised state.
4. **True.** The acid-fast bacilli block fusion of phagosome and lysosome allowing unchecked bacterial proliferation in the phagosome of macrophages.
5. **False.** It leads to the development of delayed type hypersensitivity (Type IV). Type III is immune complex mediated hypersensitivity.

RESPIRATORY CASE 2



PULMONARY METASTATIC OSTEOSARCOMA

CLINICAL HISTORY

A 17-year-old man who was previously treated for right femur osteosarcoma presented with a solitary lung nodule detected during routine follow-up chest radiograph.

MACROSCOPIC DESCRIPTION

There is a tumour nodule with heterogeneous cut-surface (red arrow). The tumour displays whitish appearance with patchy areas of central haemorrhage and necrosis. The tumour exhibits ill-defined outer margin. The central area is away from the blood supply and hence prone to necrosis. This is a haematogenous spread from the primary tumour at the femur. The blue arrow points to the residual lung tissue.

MULTIPLE CHOICE QUESTIONS

Microscopic feature of malignant neoplasm includes

1. loss of polarity.
2. dysplasia.
3. abnormal mitosis.
4. pleomorphism.
5. hyperchromatic nuclei.

ANSWERS

1. **True.** This involves abnormal orientation of cells in malignant neoplasm.
2. **False.** It is a disordered growth commonly associated with premalignant condition. It does not necessarily progress to malignancy.
3. **True.** This appearance indicates nuclear aneuploidy.
4. **True.** This is cellular variation of size and shape seen in malignant neoplasm.
5. **True.** There is abundance of DNA causing extremely dark-stained nuclei.

RESPIRATORY CASE 3



CARCINOMA OF THE LARYNX

CLINICAL HISTORY

A 53-year-old man presented with hoarseness of voice associated with otalgia for the past six months. He was a heavy smoker for the past 20 years.

MACROSCOPIC DESCRIPTION

The red arrow points to an infiltrating tumour mass located at the posterior vocal cord invading the surrounding tissue. The tumour displays ill-defined infiltrative margin. The tumour is whitish in appearance with patchy areas of haemorrhage. The blue arrow points to the epiglottis.

MULTIPLE CHOICE QUESTIONS

Regarding carcinoma of the larynx:

1. It is usually of adenocarcinomatous type.
2. It is preceded by epithelial atypia.
3. It is associated with Epstein-Barr virus infection.
4. It can be complicated by lung infections.
5. Tobacco smoking is a major risk factor.

ANSWERS

1. **False.** Squamous cell carcinoma accounts for 95% of laryngeal carcinoma
2. **True.** Epithelial changes from hyperplasia, dysplasia and carcinoma in-situ can be seen. The likelihood of developing overt carcinoma is proportional to the epithelial atypia seen.
3. **False.** EBV infection is related to nasopharyngeal carcinoma.
4. **True.** Complication with lung infection can cause death in this carcinoma.
5. **True.** Tobacco smoking is the major risk factor.